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(21)Application number : 11-350686

(71)Applicant : SUMITOMO RUBBER IND LTD

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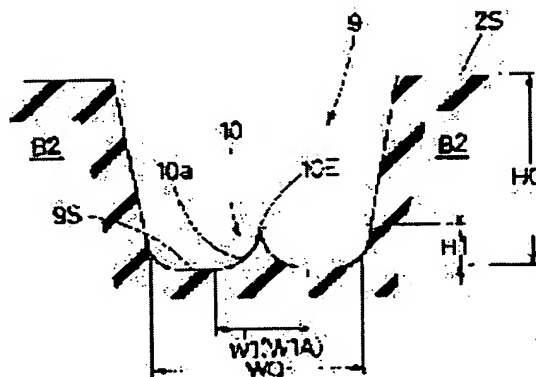
(72)Inventor : FUNAHARA KIYOSHI

## (54) PNEUMATIC TIRE AND DIE FOR VULCANIZATION THEREOF

### (57)Abstract:

PROBLEM TO BE SOLVED: To improve uniformity with suppressing rubber biting between separation surfaces.

SOLUTION: A tread surface 2S is provided with a circumferential groove 9 by recessing such that a groove bottom surface 98 thereof passes through a tire equatorial plain C or its neighborhood region Y, and a projection 10 circumferentially extended is projected on the groove bottom surface 98. A projection width W1 of the projection 10 is gradually decreased toward the radial direction from the groove bottom surface 9S to a tip 10E.



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CLAIMS

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[Claim(s)]

[Claim 1] It is the pneumatic tire characterized by for the protruding line extended to said groove bottom side in a hoop direction upheaving, and dwindling said protruding line to a tip toward a radial outside from the protruding line width-of-face fang furrow base in a cross section including a tire shaft while cutting in a tread side the hoop direction slot where a groove bottom side passes along a tire equatorial plane thru/or its near field.

[Claim 2] It is the pneumatic tire according to claim 1 with which height radial [ from said groove bottom side of a protruding line to said tip ] is characterized by a protruding line continuing between the tread land parts of the groove bottom width of face of said hoop direction slot which moreover interrupt said hoop direction slot 0.5 to 1.0 times, as for the width of face in said groove bottom side to 0.1 to 0.3 times of the radial height to a tread side and the groove bottom side of a protruding line of said hoop direction slot while having the carcass of bias structure.

[Claim 3] Have a crack surface to a tire equatorial plane thru/or its near field, and it consists of the upper metal mold and the Shimokane mold which form the tire shaping lumen equipped with the tread shaping side for tread formation by doubling and allotting this crack surface. And while said tread shaping side is equipped with the groove bottom shaping surface part which forms the groove bottom side of the hoop direction slot cut in the tread side of a tire in near [ said ] a crack surface Tire vulcanization metal mold which comes to prepare the \*\*\*\*\* prevention excision section which forms a protruding line in said groove bottom side of a notch and a tire for the arris part which a tread shaping side and said crack surface make in this groove bottom shaping surface part.

[Claim 4] Said \*\*\*\*\* prevention excision section is tire vulcanization metal mold according to claim 3 characterized by making the shape of radii which stands in a row smoothly at said shaping lumen side in a convex and said crack surface, and said groove bottom shaping surface part in a cross section including a tire shaft.

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the pneumatic tire which can prevent effectively rubber \*\*\*\* between metal mold crack surfaces, and its tire vulcanization metal mold, holding down the amount of swellings of the raw tire within metal mold to minimum, and securing uniformity highly with respect to an improvement of the groove bottom configuration of a hoop direction slot.

[0002]

[Description of the Prior Art] For example, as the amount of swellings on structures, such as a carcass and a coding sequence of a breaker, and within metal mold (the amount of expansion) is very size compared with a radial-ply tire, therefore a bias tire shows drawing 9 (A), it is suitable for vulcanization with the so-called 2 piece mold type of metal mold a which consists of upper metal mold a1 and a Shimokane mold a2, and can contribute to a cost cut or improvement in productivity greatly.

[0003] However, also in this bias tire, since the fall of uniformity is caused in order that the elongation of a carcass code may ununiformity-ize in a hoop direction and the forcing force to metal mold a moreover becomes inadequate with the increment in tension of a carcass code so that the amount of expansion within metal mold a increases, the fault of a lifting or a cone will produce rubber chips, such as raise in basic wages.

[0004] Therefore, to form the raw tire t beforehand as greatly as possible, and to reduce said amount of expansion, namely, to bring the external surface ts of the raw tire t close to the groove bottom shaping surface part b1 of metal mold a is desired.

[0005] However, the tire of the \*\*\*\* tread pattern with which this groove bottom shaping surface part b1 is formed in the crack surface c location of metal mold a, For example, when a groove bottom side manufactures the tire which has a hoop direction slot passing through a tire equatorial plane thru/or its near field, in case the raw tire t is set in metal mold a and metal mold a is closed, as shown in drawing 9 (B), the problem of biting the rubber g of the raw tire t among said crack surfaces c and c of metal mold a arises. Especially, with the tire for irregular ground combination motor bicycles, since a channel depth is size (the protrusion height of the groove bottom shaping surface part b1 is size), it becomes remarkable.

[0006] In addition, the part will be able to be burned in metal mold a, will become rubber, and will fall, and \*\*\*\* rare \*\* rubber g will cause tire debasement or defective generating, such as mixing in the following tire as a foreign matter, while it serves as weld flash and reduces the appearance of a tire.

[0007] Thus, it was difficult for the fall and rubber \*\*\*\* of uniformity resulting from expansion of the raw tire t to have the relation of an antinomy and to satisfy both enough.

[0008] Then, this invention prepares the \*\*\*\*\* prevention excision section in the arris part which the groove bottom shaping surface part and crack surface in metal mold make, and is based on forming the protruding line of the shape of a cross-section abbreviation triangle extended to the groove bottom side of a tire by this in a hoop direction. It aims at offer of the pneumatic tire which may improve uniformity, and its tire vulcanization metal mold, becoming possible to form a raw tire greatly and preventing the

appearance fall of a tire, debasement, defective generating, etc. controlling rubber \*\*\*\* effectively.

[0009]

[Means for Solving the Problem] In order to attain said purpose, while the pneumatic tire of the 1st invention of this application cuts in a tread side the hoop direction slot where a groove bottom side passes along a tire equatorial plane thru/or its near field, the protruding line extended to said groove bottom side in a hoop direction upheaves, and it is characterized by dwindling said protruding line to a tip toward a radial outside from the protruding line width-of-face fang furrow base in a cross section including a tire shaft.

[0010] In addition, while having the carcass of bias structure in this pneumatic tire, as for the width of face in said groove bottom side to 0.1 to 0.3 times of the radial height to a tread side and the groove bottom side of a protruding line of said hoop direction slot, it is desirable [ height radial / from said groove bottom side of a protruding line to said tip ] that a protruding line continues between the tread land parts of the groove bottom width of face of said hoop direction slot which moreover interrupt said hoop direction slot 0.5 to 1.0 times.

[0011] Moreover, the tire vulcanization metal mold of the 2nd invention of this application has a crack surface to a tire equatorial plane thru/or its near field. It consists of the upper metal mold and the Shimokane mold which form the tire shaping lumen equipped with the tread shaping side for tread formation by doubling and allotting this crack surface. And said tread shaping side While having the groove bottom shaping surface part which forms the groove bottom side of the hoop direction slot cut in the tread side of a tire in near [ said ] a crack surface It is characterized by preparing the \*\*\*\*\* prevention excision section which forms a protruding line in said groove bottom side of a notch and a tire for the arris part which a tread shaping side and said crack surface make in this groove bottom shaping surface part.

[0012] In addition, as for said \*\*\*\*\* prevention excision section, in this tire vulcanization metal mold, it is desirable in a cross section including a tire shaft to make the shape of radii which stands in a row smoothly in said shaping lumen side in a convex and said crack surface, and said groove bottom shaping surface part.

[0013]

[Embodiment of the Invention] Hereafter, one gestalt of operation of the pneumatic tire of the 1st invention of this application is explained with one gestalt of operation of the tire vulcanization metal mold of the 2nd invention using a drawing. In addition, drawing 1 shows the meridional section (cross section including a tire shaft) of a pneumatic tire, and drawing 2 shows the tread pattern.

[0014] A pneumatic tire 1 is equipped with the tread section 2, the sidewall section 3 extended from the both ends to the method of the inside of tire radial, and the toe of bead 4 located in a way edge among each sidewall section 3 in drawing 1.

[0015] In addition, in this example, it forms so that the case where a pneumatic tire 1 is formed as a tire for motor bicycles of irregular ground combination may be illustrated, and tread side 2S may curve smoothly in the shape of convex radii in a meridional section and the width between the tread edges Te and Te may turn into the tire maximum width. in order to secure turnability especially high in this example -- the ratio of the radial distance Lc between the equatorial point on tread side 2S, and the tread edge Te, and the tire shaft-orientations distance Le -- the camber value which is Lc/Le is set to 0.45-0.65. The case of 0.54 is illustrated in this drawing.

[0016] Moreover, the breaker 7 arranged on a way and the outside of said carcass 6 is formed in the pneumatic tire 1 among the carcass 6 of said toe of bead 4 and the bias structure of straddling between four, and the tread section 2.

[0017] Said carcass 6 has cuff section 6B turned up and stopped by the both sides of body section 6A from the tread section 2 to the bead core 5 of a toe of bead 4 through the sidewall section 3 around said bead core 5. By return [ A / this / body section 6 ], bead APEC SUGOMU 8 which stretches from the bead core 5 in the shape of a taper to the method of the outside of tire radial between section 6B is allotted, and the rigidity of a toe of bead 4 and reinforcement are raised.

[0018] Moreover, said carcass 6 consisted of carcass ply of two or more sheets (this example two sheets)

which carried out the inclination array of the carcass code at the include angle of 25 - 60 degrees to the tire hoop direction, and the mistake in the sense of an inclination is made so that each carcass code may cross mutually by mutual [ between plies ]. As a carcass code, organic fiber codes, such as nylon, polyester, and rayon, are adopted preferably.

[0019] A breaker code is in said carcass code, abbreviation, etc. by carrying out to a tire hoop direction, and said breaker 7 consists of include-angle range and breaker ply of one or more (this example one sheet) sheets preferably arranged at the include angle of 35 - 60 degrees, protects a carcass 6 to the impact from a road surface, and prevents that the trauma received in the tread section 2 reaches a carcass 6. As a breaker code, the same organic fiber code as said carcass is used suitably. In addition, a breaker 7 can also be eliminated.

[0020] Next, tread-groove G which includes at least the hoop direction slot 9 where groove bottom side 9S pass along the tire equatorial plane C thru/or its near field Y as shown in drawing 2 was cut in said tread side 2S, and tread side 2S are classified into the tread land part J of said tread-groove G and its remainder by this.

[0021] In this example, the case where the block pattern with which said tread land part J consists of two or more blocks B containing the block B1 of the center which arranges the tire equatorial plane C top to a hoop direction, and block B-2 of the inside arranged to a hoop direction on both sides of the tire equatorial plane C is made is illustrated. Therefore, by this example, said hoop direction slot 9 is formed in the hoop direction interrupted and divided by the central block B1 as a discontinuous slot while it is extended in the tire equatorial plane C top through between inner block B-2 and B-2.

[0022] And in this application, it has one description to have upheaved the protruding line 10 extended in a hoop direction to said groove bottom side 9S of the hoop direction slot 9.

[0023] In addition, when the "near field Y" of said tire equatorial plane C means the field which is far apart from the tire equatorial plane C in tire shaft orientations in 20% or less of small distance of said distance Le and two or more hoop direction slots 9 are allotted to this near field Y, that groove bottom center line forms said protruding line 10 in the hoop direction slot 9 nearest to the tire equatorial plane C at least.

[0024] In this example, this protruding line 10 has really joined the hoop direction edge of a protruding line 10 to the block B1 of said center while continuing between the block (tread land part) B1 of the center which interrupts said hoop direction slot 9, and B1. In addition, in following a hoop direction, without interrupting said hoop direction slot 9 by block, a protruding line 10 follows a hoop direction similarly.

[0025] Moreover, a protruding line 10 makes the shape of a cross-section abbreviation triangle dwindled to tip 10E toward a radial outside from the protruding line width-of-face W1 fang-furrow base 9S, as shown in drawing 3. And side side 10a has the desirable thing which stand in a row smoothly in groove bottom side 9S from a viewpoint which controls the crack from groove bottom side 9S by stress concentration and it is supposed that it is circular, for example, can be made into the radii inscribed in said groove bottom side 9S like this example, or the radii which intersects said groove bottom side 9S as shown in drawing 4.

[0026] Moreover, as for the height H1 radial [ from said groove bottom side 9S in a protruding line 10 to said tip 10E ], it is desirable to carry out by 0.1 to 0.3 times the radial height H0 from said groove bottom side 9S to tread side 2S of said hoop direction slot 9. Furthermore, as for width-of-face W1A of groove bottom side 9S of said protruding line 10, it is desirable to carry out by 0.5 to 1.0 times the groove bottom width of face W0 of said hoop direction slot 9. In addition, when the groove bottom width of face of said hoop direction slot 9 changes in a hoop direction, it considers as the groove bottom width of face W0 with the minimum width of face. Moreover, generally, in the case of the tire for motor bicycles, said height H1 is usually about 1.5-2.5mm, and width-of-face W1A is about 4.0-8.0mm.

[0027] Here, in case said protruding line 10 carries out vulcanization shaping of the pneumatic tire 1 with the 2 piece mold type metal mold 20, it prevents that rubber \*\*\*\* occurs between the crack surface 21 of metal mold 20, and 21.

[0028] Consequently, while becoming possible to stop the amount of expansion within the possibility 20

of forming a raw tire as greatly as possible, i.e., metal mold, to the minimum, equalizing the elongation of a carcass code to a hoop direction and improving uniformity by formation of this protruding line 10, the forcing force to metal mold 20 is secured enough, and rubber chips, such as raise in basic wages, can be controlled.

[0029] In addition, less than  $[0.1 \times H_0]$ , the rubber \*\*\*\* prevention effectiveness also becomes the debasement of a tire, or the cause of generating of a defective, while said height  $H_1$  of a protruding line 10 is not fully demonstrated, therefore causes the appearance fall in weld flash. Moreover, with the tensile stress of the hoop direction by driving force etc., if height  $H_1$  exceeds  $0.3 \times H_0$ , as shown in drawing 5, it will be easy to generate a crack in tip 10E, it will be set to it, and tire reinforcement will be fallen. When \*\*\*\*  $W_1A$  is less than  $[0.5 \times W_0]$ , in order to secure said height  $H_1$ , side side 10a becomes a steep slope too much, and makes the crack from groove bottom side 9S or tip 10E induce. Conversely, if width-of-face  $W_1A$  exceeds  $1.0 \times W_0$ , it will interfere with block B-2 of adjoining inside, and groove bottom side 9S by the side of this block B-2 will become a crack initiation inclination.

[0030] In addition, it is not necessary to form said protruding line 10 on the groove bottom center line of groove bottom side 9S, and, on the other hand, it can also be swerved and formed in /another side from this groove bottom center line.

[0031] Next, the rubber \*\*\*\* prevention effectiveness of a protruding line 10 mentioned above is explained below with the vulcanization metal mold 20 of this pneumatic tire 1.

[0032] Said tire vulcanization metal mold 20 is the so-called 2 piece mold type of metal mold, as shown in drawing 6, had the crack surface 21 to the tire equatorial plane C thru/or its near field Y, and is equipped with upper metal mold 21U and Shimokane mold 21L which form the tire shaping lumen H by doubling and allotting this crack surface 21. In addition, upper metal mold 21U and Shimokane mold 21L can be displaced relatively up and down by rise and fall of the ram of a press by attaching said upper metal mold 21U in the ram side of a press, and attaching Shimokane mold 21L in a bed side again, respectively.

[0033] Moreover, said tire shaping lumen H is substantially formed in an equal profile configuration with the profile configuration of said pneumatic tire 1 from the tread shaping side 22 for nothing and tread shaping, the sidewall shaping side 23 for sidewall shaping, and the bead-forming side 24 for bead forming.

[0034] And while said tread shaping side 22 is equipped with the groove bottom shaping surface part 25 which forms groove bottom side 9S of the hoop direction slot 9 cut in tread side 2S of a tire 1 in said crack surface 21 neighborhood The \*\*\*\*\* prevention excision section 26 which forms said protruding line 10 in a notch and said groove bottom side 9S for the arris part K which the tread shaping side 22 and said crack surface 21 make in this groove bottom shaping surface part 25 is provided so that it may expand to drawing 7 and may be shown.

[0035] This \*\*\*\*\* prevention excision section 26 has the desirable thing which stand in a row smoothly in said shaping lumen H side to the both sides of a convex and said crack surface 21, and said groove bottom shaping surface part 25 and it is supposed that it is circular in a meridional section. Although the case of the shape of an inscribed circle which touches both sides is illustrated in this example, it is also good to form in the shape of [ which intersects both sides or one side ] a crossover circle.

[0036] Moreover, the height [ in / like / the above-mentioned from a viewpoint of generating control of the rubber \*\*\*\* prevention effectiveness and a crack / in the excision height  $h_1$  and the excision width of face  $w_1$  of said \*\*\*\*\* prevention excision section 26 / said protruding line 10 ]  $H_1$  is set up for the range of  $0.1 \times H_0$ - $0.3 \times H_0$ , and width-of-face  $W_1A$  so that it may become the range of  $0.5 \times W_0$ - $1.0 \times W_0$ .

[0037] That is, it is desirable to make said excision height  $h_1$  into 0.1 to 0.3 times of the height  $h_0$  radial [ from said groove bottom shaping surface part 25 to said tread shaping side 22 ], and to make excision width of face  $w_1$  into 0.5 to 1.0 times of the width of face  $w_0$  of the groove bottom shaping surface part 25. In addition, as for the radius of curvature R of said \*\*\*\*\* prevention excision section 26, it is desirable to consider as the range of further 2.0-4.0mm from a viewpoint of generating control of a crack.

[0038] said arris part K which approaches the raw tire t most in case said Shimo metal mold 21L descends and metal mold 20 closes very -- notching -- him -- the \*\*\*\* lump prevention excision section 26 is formed. Therefore, the contact of the groove bottom shaping surface part 25 of Shimokane mold 21L and the raw tire t at the time of said descent itself is mitigated or controlled.

[0039] Moreover, as shown in drawing 8, the dead-air-space section M for protruding line 10 formation is formed of said \*\*\*\*\* prevention excision sections 26 and 26. Therefore, contact into the raw tire t arises at the time of descent, and since this rubber can run in in said dead-air-space section M also when rubber came together and upheaves between a crack surface 21 and 21, rubber \*\*\*\* between a crack surface 21 and 21 is prevented effectively.

[0040] As mentioned above, although especially the desirable operation gestalt of this invention was explained in full detail, this invention can be applied to the various bias tires formed by metal mold 2 piece mold type [, such as a tire for passenger cars besides the tire for motor bicycles, ], and the vulcanization metal mold of those, without being limited to the operation gestalt of illustration.

[0041]

[Example] While making the tire for motor bicycles of irregular ground combination of the structure which tire size is 4.10-18, and is shown in drawing 1 and 2 as an experiment based on the specification of Tables 1 and 2, the rubber \*\*\*\*\* situation of each sample offer tire, appearance nature, and the generating situation of a crack were tested and compared. The test approach is as follows.

[0042] (1) Rubber \*\*\*\*\* situation : the rubber \*\*\*\*\* situation at the time of fabricating with vulcanization metal mold was inspected visually, what has checked generating was made into x and what was not able to be checked was made into O.

(2) Appearance nature : organic-functions evaluation of the appearance was carried out by the visual inspection, and the thing of x and Appearance O.K. was made into O for spoiling an appearance.

(3) The generating situation of a crack : equipped the rear wheel of a motor bicycle (250 cc) with the sample offer tire with a rim (2.15) and internal pressure (225kpa), and carried out high-speed transit of the distance (30km) for the test course by maximum velocity 210 km/h, and inspected visually the generating situation of the crack in a hoop direction slot, what has checked generating after transit was made into x, and what was not made was made into O.

[0043]

[Table 1]

	比較例1 (従来)	実施例 1	実施例 2	実施例 3	実施例 4	実施例 5	実施例 6
周方向溝の							
・高さH0 <mm>	11.5	11.5	11.5	11.5	11.5	11.5	11.5
・溝底幅W0 <mm>	6.0	6.0	6.0	6.0	6.0	6.0	6.0
突条の							
・高さH1 <mm>	0	1.0	1.5	2.0	2.5	3.0	3.5
(比H1/H0) ×100	—	8.7	13.0	17.4	21.7	26.1	30.4
・幅W1 <mm>	0	2.0	3.0	4.0	5.0	6.0	7.0
(比W1/W0) ×100	—	33	50	67	83	100	117
・曲率半径R <mm>	0	1.0	1.5	2.0	2.5	3.0	3.5
ゴム噛みの発生状況	×	×	○	○	○	○	○
外観性	○	○	○	○	○	○	○
クラックの発生状況	○	○	○	○	○	○	○

[0044]

[Table 2]



	実施例 7	実施例 8	実施例 9	実施例 10	実施例 11
周方向溝の					
・高さ H 0 <mm>	11.5	11.5	11.5	11.5	11.5
・溝底幅 W 0 <mm>	6.0	6.0	6.0	6.0	6.0
突条の					
・高さ H 1 <mm>	1.0	1.0	2.0	3.0	3.0
・ $(\text{比 } H 1 / H 0) \times 100$	8.7	8.7	17.4	26.1	26.1
・幅 W 1 <mm>	2.0	3.5	5.5	7.5	9.0
・ $(\text{比 } W 1 / W 0) \times 100$	3.3	5.8	9.2	12.5	15.0
・曲率半径 R <mm>	1.0	2.0	3.0	4.0	5.0
クラックの発生状況	×	○	○	○	○
横のブロックとの干渉*	○	○	○	○	×

注) 横のブロックと干渉する時×とした

[0045]

[Effect of the Invention] Since this invention is constituted like the above statement, it can improve uniformity, becoming possible to form a raw tire greatly and preventing the appearance fall of a tire, debasement, defective generating, etc. controlling rubber \*\*\*\* effectively.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of one example of the pneumatic tire of the 1st invention of this application.

[Drawing 2] It is the development view showing the tread pattern.

[Drawing 3] It is the sectional view showing an example of a protruding line.

[Drawing 4] It is the sectional view showing other examples of a protruding line.

[Drawing 5] It is the perspective view of a protruding line.

[Drawing 6] It is the sectional view of one example of the vulcanization metal mold of the 2nd invention of this application.

[Drawing 7] It is the sectional view showing an example of the \*\*\*\*\* prevention excision section.

[Drawing 8] It is a diagram explaining this application operation effectiveness.

[Drawing 9] The sectional view in which (A) shows the conventional vulcanization metal mold, and (B) are the diagrams explaining the trouble.

[Description of Notations]

2S Tread side

6 Carcass

9 Hoop Direction Slot

9S Groove bottom side

10 Protruding Line

21 Crack Surface

21U Upper metal mold

21L Shimokane mold

22 Tread Shaping Side

25 Groove Bottom Shaping Surface Part

26 \*\*\*\*\* Prevention Excision Section

C Tire equatorial plane

H Tire shaping lumen

K Arris part

Y Near field

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[Translation done.]

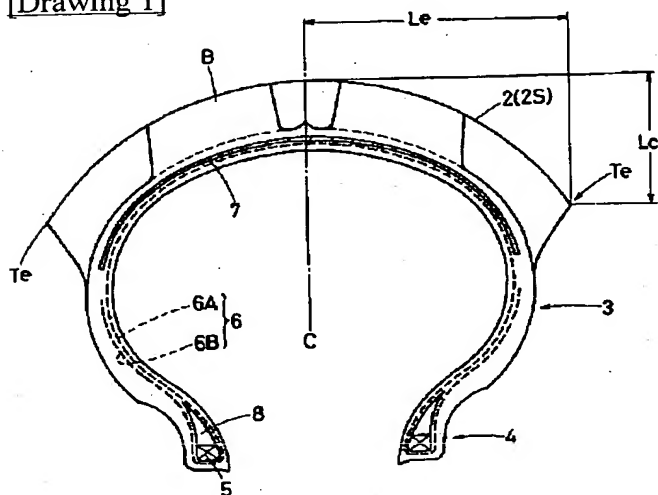
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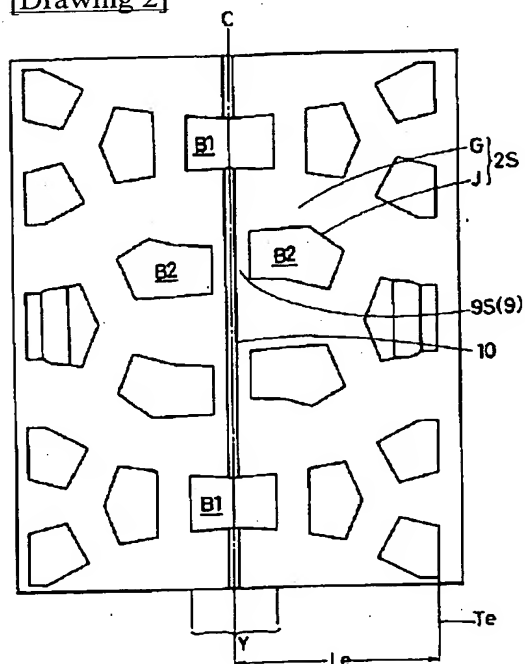
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## DRAWINGS

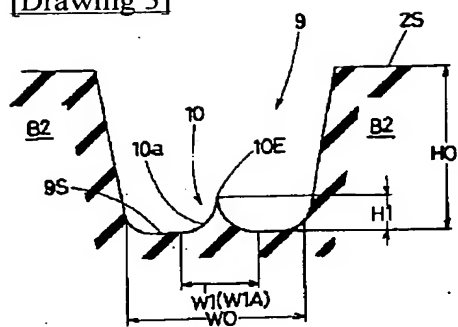
[Drawing 1]



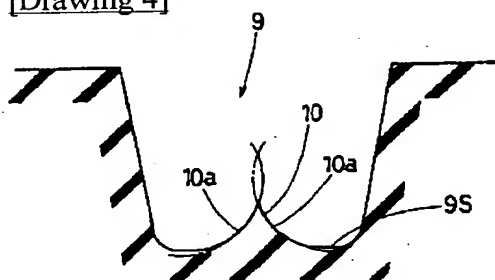
[Drawing 2]



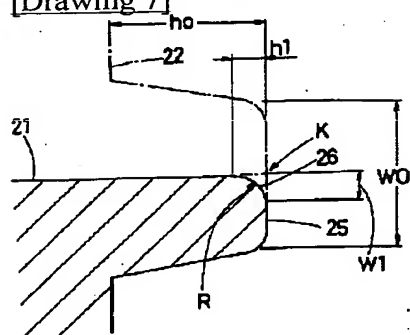
[Drawing 3]



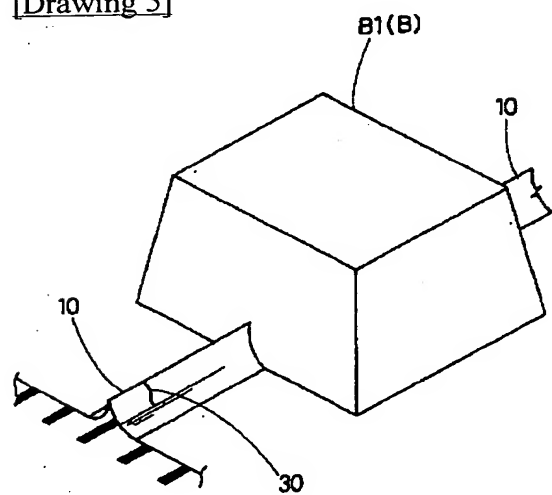
[Drawing 4]



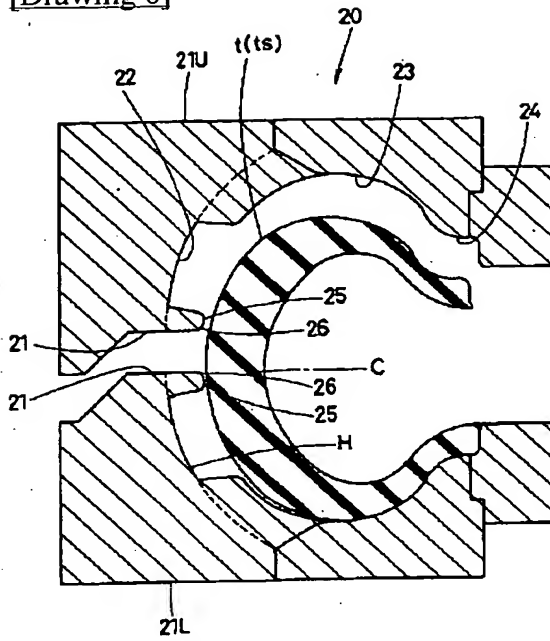
[Drawing 7]



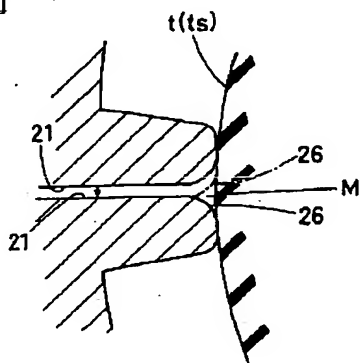
[Drawing 5]



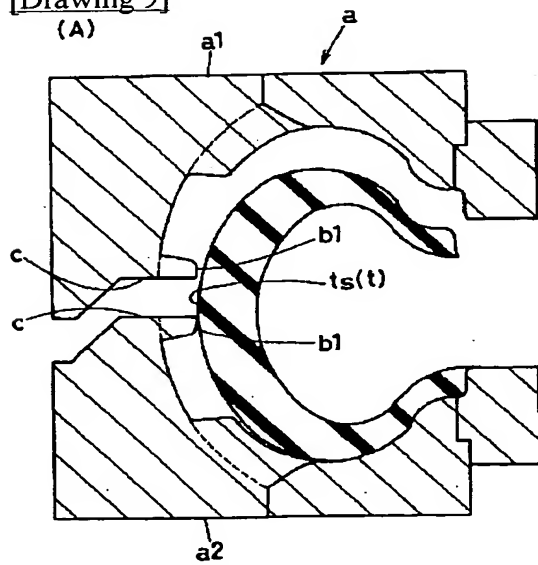
[Drawing 6]



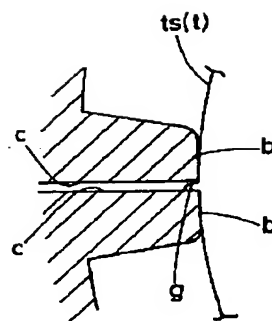
[Drawing 8]



[Drawing 9]



(B)



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[Translation done.]

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